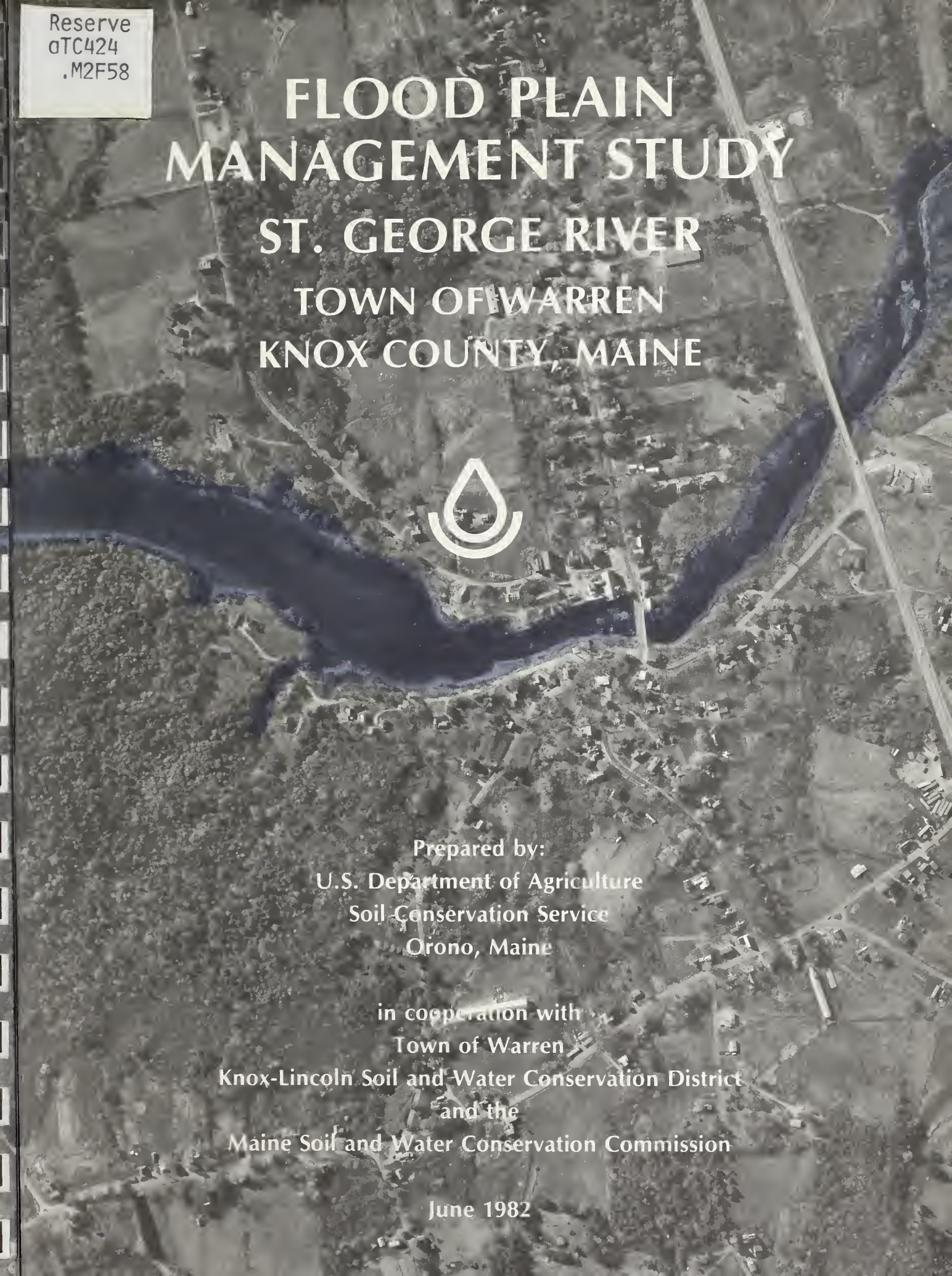
FLOOD PLAIN MANAGEMENT STUDY

ST. GEORGE RIVER

TOWN OF WARREN
KNOX COUNTY, MAINE



Prepared by:
U.S. Department of Agriculture
Soil Conservation Service
Orono, Maine

in cooperation with
Town of Warren
Knox-Lincoln Soil and Water Conservation District
and the
Maine Soil and Water Conservation Commission

June 1982

ACKNOWLEDGEMENTS

Appreciation is expressed for the assistance given by the following agencies and organizations during the study:

University of Maine, Cooperative Extension Service, Orono, Maine

Knox-Lincoln Soil and Water Conservation District

Time and Tide RC&D Project Sponsors

Town of Warren

U.S. Army, Corps of Engineers, Waltham, MA

U.S. Geological Survey, Augusta, ME

National Oceanic and Atmospheric Administration

James W. Sewall Company, Old Town, ME

Maine Soil and Water Conservation Commission

Maine Department of Transportation, Augusta, Maine

A special expression of thanks is extended to the corps members and staff of the Young Adult Conservation Corps (YACC) at Camp Tanglewood, Lincolnville, Maine for the outstanding work that was done in performing the field surveys that were so fundamental to this study.

Appreciation is also extended to the many property owners who granted access to their property for obtaining field surveys and gathering other necessary basic data.

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ST. GEORGE RIVER

WARREN, MAINE

Introduction

This report presents flood plain information along the St. George River North Pond, South Pond, White Oak Pond and Seven Tree Pond within the town of Warren. Data generated for this study consist of a flood hazard evaluation including flood plain maps and profiles, and an inventory of natural resource values served by the flood plains.

The town of Warren will use the technical information provided in this study to identify flood plain areas and as a guide for developing a flood plain management program for the St. George River. This report will provide to the town a basis upon which to comply with the State of Maine's "Mandatory Zoning and Subdivision Control Law" which apply to shoreland areas. Such regulations are needed to minimize loss of life and property damage from future floods as well as to prevent environmental degradation of the area's resources and to ensure orderly community growth. Data generated by this study will also be useful to the town of Warren in complying with the provisions of the National Flood Insurance Program.

The study was performed in response to a request by the town of Warren to the Maine Soil and Water Conservation Commission (MSWCC). A cooperative Plan of Work approved by the town and the MSWCC in July, 1980 and authorized by the Soil Conservation Service (SCS) in August, 1980 provides the basis for funding and also outlines the areas to be included and scope of the study.

The SCS, United States Department of Agriculture, carries out Flood Plain Management Studies under the provisions of Federal Level Recommendation 3 of a Unified National Program for Flood Plain Management, Water Resources Council, September 1979, in accordance with Section 6 of Public Law 83-566, the Watershed Protection and Flood Prevention Act (1954). Priorities of studies in Maine are established by the MSWCC through a Joint Coordination Agreement between the Commission and SCS to carry out these studies.

Description of Study Area

The St. George River, located in Knox, Lincoln, and Waldo Counties, Maine, has a drainage area of 232 square miles to the downstream limit of the study area in the town of Warren. The St. George River originates at the outlet of Little Pond in the town of Liberty and flows southerly through the towns of Montville, Searsmont, Appleton, Union, Warren, Thomaston, South Thomaston, St. George and Cushing where it joins the Atlantic Ocean. It is located approximately 150 miles northeast of Boston, 50 miles southwest of Bangor, and 30 miles east of Augusta (see Location Map). The hydrologic unit code for the area is 01050003.

Two separate sections of the New England Physiographic Province occur in Knox County. The northern half of the Knox County mainland is in the New England Upland Section, with several hills having summit elevations in the 1000 to 1380 foot range. The southern half of Knox County, including the coastal islands are in the Seaboard Lowland Section, with elevations generally less than 300 to 400 feet. In the uplands, drainage is well developed and topography is mature. The lowlands are rather poorly drained.

The topography of the watershed ranges from an elevation of 1300' NGVD, 1929 (formerly mean sea level) at the peak of Ragged Mountain on the Camden-Rockport boundary to sea level on the St. George River in the village of Warren. The watershed is predominately hilly and rolling with numerous lakes and ponds scattered throughout the largest being:

Name	Surface Area (1) (Acres)	Drainage Area (Square Miles)
St. George Lake	1,020	6.62
Quantabacook Lake	610	14.89
Crawford Pond	585	30.13
Alford Lake	540	7.26
South Pond	520	9.59
Sennebec Pond	510	112.20
Seven Tree Pond	490	158.46
Stevens Pond	400	11.39
North Pond	325	17.59

Watershed land use can be broken down as follows:

Forest Land	70%
Open Land	25%
Water Areas	5%
Urban	0.2%

(1) Reference Number - Bibliography

ST GEORGE RIVER FLOOD PLAIN MANAGEMENT STUDY
WARREN, MAINE

LOCATION MAP

Several hundred million years of the earth's history are represented by the many different kinds of bedrock found in Knox and Lincoln Counties. Since the formation of the area's bedrock, the slow but persistent process of erosion removed a great amount of rock. However, the present landscape is a result of the events of the Pleistocene epoch, which began about 2 million years ago. Huge ice sheets advanced and retreated over Knox and Lincoln Counties probably as many as four times during that period, but evidence remains of only the last major glaciation which occurred about 18 thousand years ago.

Quarrying of marble (metamorphosed limestone) for use in the local manufacturing of Portland cement is of major importance in the Union-Thomaston-Rockland area of Knox County. This material is also used for agricultural lime.

The mining of the area's glacial ice-contact and outwash deposits of sand and gravel for use in the construction industry continues to be of economic importance, as is the production of crushed stone.

The soils in the lowlands and stream terraces are dominantly Boothbay and Swanville soils with a few scattered bottom lands containing Fryeburg soils. A few high stream terraces are gravelly and contain Masardis soils. The soils on the uplands are formed mainly in glacial till and are dominantly Marlow, Peru, Tunbridge and Lyman soils. Knox and Lincoln Counties have been completely soil mapped and the soil survey is scheduled for publication in January 1984. In the interim, soil information is available for the St. George River Watershed at the SCS field office in Waldoboro.

The St. George River is located in the Coastal Climatic Zone and has average daily temperatures that range from 23° F in January to 66° F in July. The average annual precipitation is approximately 44 inches which include the water equivalent of some 70 inches of snow (2). Although average precipitation is rather evenly distributed throughout the year, monthly totals are about four inches during the winter as compared to three inches during the summer in the Coastal Zone. Thunderstorm activity is somewhat suppressed by the effects of the cool ocean while winter precipitation is increased by coastal storms or "northeasters".

The study area is located within the town of Warren and includes North Pond, South Pond, White Oak Pond, Seven Tree Pond and 12.3 miles of the St. George River. The major land uses include private recreational properties, wetlands, farmland, a town park, several businesses in the village of Warren and tidal areas extending downstream from the village.

Eight bridges span the flood plain within the study area. (Bridge Data - Appendix). There are no functional dams located within the study area.

Natural Values

Relative to the many wilderness rivers in Maine, the St. George River flows through a very populated section of the state. Yet once on the river one gets the impression that he is in a relatively "wilderness" area.

Overall the river is rather placid as it winds its way through the countryside lined with tall hardwood trees, at times forming a canopy over the river. There are no severe rapids or rips to speak of except in the vicinity of the "Old Powder Mill" approximately 0.5 mile upstream of state Route 90.

The year 1794 witnessed the beginnings of a canal that was to bypass several stretches of the St. George River, such as the above, which were difficult for navigation. After the efforts of many people, including General Henry Knox, the waterway was used intermittently. The planners had intended to make a usable waterway from tidewater in Warren to places as far north as Searsmont and Liberty. The width of the structure indicates that the boats were small and the lack of a complete tow path suggests that the boats were poled through the canal. Rock structures within the canal tells of the location of locks which were necessary to provide different water levels in the river. The most extensive of these are found in Warren, on the east side of the river just below the Powder Mill Road. After well over one hundred years of neglect, the St. George River Canal has become recognized as a National Register Historic Site.

There is little prime farmland in the flood plain but a number of farm pastures reach down to the river banks. For the most part the flood plain area is wooded and river banks appear stable with little soil erosion occurring. A large wetland area surrounding White Oak Pond provides habitat for nesting water fowl. Signs of wildlife such as otter slides, beaver, muskrat and deer are visible along the flood plains.

The river supports predominately warm water species of fish including smallmouth bass, perch and pickerel as well as anadromous species such as alewives which are commercially harvested. Warren is the only town on the river which has retained the fishing rights which were granted to it when Maine was part of Massachusetts. Alewives which head upstream from the sea on their annual spawning run, are trapped and sold as bait to lobster fishermen in the mid-coastal area.

The most recent classification of the St. George River according to Maine Department of Environmental Protection standards is Class C, i.e., waters of this classification are of such quality as to be satisfactory for recreational boating and fishing, for fish and wildlife habitat and for other uses except potable water supplies and water contact recreation, unless such waters are adequately treated. A water quality study of the river, by the towns of Thomaston and Warren through a Coastal Zone Management grant, is scheduled to be completed in 1982.

Although a survey has not been conducted to determine present use levels, it appears that relatively little use is made of the river for canoeing, boating, and fishing. There is very little visual evidence of even moderate day use, i.e., lack of litter and river bank erosion due to foot traffic and/or boat and canoe launching. Signs of random overnight camping were not in evidence.

The ease with which the river can be canoed could be attractive to the beginning canoeist and families with small children. The section of the river from Seven Tree Pond to the "Old Powder Mill" would make an excellent day trip.

Basically there are three alternatives which could be considered in planning for the recreational use of the St. George River:

(1) Development to accommodate day use

(2) Development to accommodate overnight users

(3) Leave the river in its current state with no development

As each alternative is considered it should be kept in mind that developing a recreational management plan for the St. George River in essence is a plan to manage people - current and future users of the river.

Day Use Facilities

The section of the river from the outlet of Seven Tree Pond to Route 90 is well suited for a day trip. Shorter trips can be taken by launching at various locations below Seven Tree Pond.

In order to accommodate day use various public access points should be provided. These should consist of a good gravel launching area (ramp) to the river, parking area, trash cans, and toilet facilities. The number provided would be dependent on the various trips in terms of time which are decided upon. The existing boat launching facilities at Ayer Park can serve as an access point for a trip down the St. George River.

A suitable portage trail would be needed at the "Old Powder Mill Site" for those who would not canoe the falls and pitch at this location. The town picnic area at the junction of the St. George River and Route 90 could serve as a terminal point for a trip.

Designated sites for day users to have lunch would be needed. These sites could consist of a suitable area to beach canoes, a fireplace, picnic table and pit toilet.

If additional access points are located below Seven Tree Pond as previously mentioned, they could also serve as lunch grounds for day users.

Overnight Facilities

There are those who would be interested in a canoe-camping trip on the river. Rather than making the trip in one day, they may be interested in setting up camp in one location for one or more nights.

To meet these needs, overnight facilities in the form of wilderness campsites could be provided. These sites might include a picnic table, fireplace, pit toilet, level area to pitch a tent and a suitable area to beach a canoe. Trash cans have been purposely omitted since users would be expected to carry out their trash. Suitable sites could be located at random along the river and could be varied in size to accommodate various size groups.

A second alternative to providing overnight facilities would be the development of a commercial campground by the private sector (developed by an individual for profit) at some central location on the river.

Leave As Is - Do Nothing

A final alternative would be to do nothing and leave the river as it is now with no day use or overnight accommodations provided.

There are some long range effects this could have on the river. If the current use levels remain as they are now there probably would be no harmful impact on the river and its environment. Should use levels increase substantially over time and no facilities provided or regulations placed on the use of the river, signs of resource degregation will appear. This could be in the form of litter, trespassing, pollution from excess human fecal matter in flood plains, river bank erosion, etc.

Planning for the future recreational use of the St. George River should be done now before problems resulting from increased use occur.

Flood Problems

The greatest frequency of flooding occurs in the early spring when substantial rains and melting snow combine to produce heavy runoff. Occasional flash floods occur from localized summertime thunderstorms but because of the vast amount of storage in the watershed and the generally small volume of runoff associated with these storms, significant flood damages have not been experienced other than minor road washouts, etc.

The most recent significant flooding in the watershed occurred on March 15, 1977 when in excess of four inches of rain fell on snow covered ground causing flooding of the Union Fairgrounds and low lying properties adjacent North and South Ponds, Round Pond and Seven Tree Pond. The old Augusta Road between North Pond and Seven Tree Pond was flooded to a depth of several feet. Based upon several high water marks in the area this flood is estimated to have a frequency of about 25 years. Other floods in the area occurred in 1936, 1940, 1954, and 1973.

The projected 100-year and 500-year floods will inundate some 838 acres and 996 acres respectively within the study area. The following table summarizes the areas subject to flooding:

	Approximate Flood Plain Areas (Acres)[1/]	
	100-Year	500-Year
St. George River		
Woodland	301	351
Agricultural Land	35	49
Wetlands	205	226
Urban[2/]	3	5
Subtotal	544	631
Seven Tree Pond		
Woodland	12	12
Wetlands	3	3
Subtotal	15	15
North Pond (To U.S. Rte 1)		
Woodland	30	43
Agricultural Land	5	7
Wetlands	26	36
Subtotal	61	86
South Pond (To U.S. Rte 1)		
Woodland	91	135
Agricultural Land	1	2
Wetlands	122	122
Urban[2/]	4	5
Subtotal	218	264
GRAND TOTAL	838	996

1/ Does not include normal river, pond or tidal areas.
2/ Includes commercial and residential areas and roads and bridges.

Flood Plain Management

In 1971 the State of Maine enacted the "Mandatory Zoning and Subdivision Control Law" (Chapter 424, Sec. 4811 thru 4814 of the Maine Statutes) which require all municipal units of government to adopt zoning and subdivision control ordinances for shoreland areas. Shoreland areas are defined as land within 250 feet of the normal high water mark of any pond, river or salt water body and include at least a major portion of the flood plain.

Since 1975 the town of Warren has participated in the "Emergency" phase of the National Flood Insurance Program. This permits existing dwellers within the approximate 100-year flood plain to purchase up to $45,000 worth of flood insurance coverage at subsidized rates on their homes and contents ($100,000 for multi-family and small businesses). The community must require building permits for all proposed construction and review the permit to assure that sites are reasonably free from flooding. For the flood prone areas it is also required that structures be properly anchored and that construction materials and methods be used that will minimize flood damage.

This report is intended to provide a technical basis for arriving at solutions to minimize potential flood damages. General nonstructural solutions include:

1. Land use planning
2. Flood plain regulations

3. Flood plain acquisition
4. Conservation easements
5. Flood insurance (Regular Program)
6. Periodic maintenance of bridges, culverts and stream channels including ice and debris removal, etc.
7. Flood proofing individual flood prone properties.

The numerous lakes and ponds and wetlands within the watershed when considered together with their present storage capacities have a very significant impact on reducing peak flood flows in the study area. It is important therefore, that all dams be adequately maintained to provide safe passage of flood flows. It is equally important that wetlands be kept from being filled or developed.

Structural measures such as dams or stream channel improvements are not appropriate here since sufficient flood damages do not exist in the study area to justify the expense of such measures.

Floodways

Any encroachments in the flood plain which increase the elevation of the land and/or present obstructions to flood flows will reduce the flood carrying capacity, resulting in increased flood heights and flow velocities. Flood hazards both upstream and downstream of the encroachment itself will generally be increased in these situations. One aspect of

flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. Under this concept the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the main channel or watercourse plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be conveyed without substantial increase in flood heights. Minimum standards of the Federal Insurance Administration (FIA) limit such increases in flood heights to 1.0 foot, provided that hazardous velocities do not result. The floodway fringe includes that portion of the flood plain that can be completely obstructed without increasing the water surface elevation of the 100-year flood by more than 1.0 foot at any point. Theoretical floodways were computed for the St. George River from Middle Road downstream to Warren Village and were computed on the basis of equal conveyance reduction from each side of the flood plain. Flood plain encroachments were not judged to be appropriate in tidal areas or adjacent to lakes and ponding areas.

Floodway data are not included in this report but may be obtained upon request from the U. S. Soil Conservation Service, USDA Office Building, University of Maine, Orono, Maine 04473, telephone (207)-866-2132.

Use of Technical Data

This report contains flood profiles, photo base flood plain maps, selected valley cross sections and other information which indicate the extent of potential flooding along the St. George River, Seven Tree Pond

and North and South Ponds in the town of Warren. Four floods were analyzed, the 10-year (10 percent chance) flood, 50-year (2 percent chance) flood, 100-year (1 percent chance) flood and the 500-year (0.2 percent chance) flood.

The results of this study are summarized in the Flood Profiles which depict the elevations of the above four floods throughout the study area. The analyses do not account for the unpredictable obstructing effects of ice or other debris which could reduce the capacity of the channel and/or bridges during flooding conditions. Thus, the elevations presented in this report should be considered minimum for flood plain management purposes.

The Flood Plain Maps include a delineation of the 100-year and 500-year flood boundaries and the 100-year flood elevations. Where only one line is shown there is no appreciable difference in the flood boundaries. Due to variations in relief and scale, the areas outlined on the maps are approximate. To check a specific property the user should locate the property on the appropriate Flood Plain Map and read the desired frequency flood elevation from the corresponding location on the Flood Profiles. Cross section locations as shown on the maps and profiles can be used as references for this purpose. By comparing the elevation from the profiles to the surveyed elevation of the property in question, the flooding frequency of that property can be estimated. Flood elevations for Seven Tree Pond, White Oak Pond and North and South Ponds can be

obtained from the Pond Data table (Appendix). Elevation bench marks which are located on the Flood Plain Map Index and described in the Appendix can be used as starting points to transfer elevations (NGVD) to the desired properties.

Also included are selected valley cross sections which show the relationship of various floods to existing topography under unobstructed flow conditions.

The following tables are contained in the Appendix:

Selected Flood Discharges - Provides rates of flow in cubic feet per second for the 10-year, 50-year, 100-year and 500-year floods within the study area. This data can be used as a guide for the hydraulic design of new bridges and/or stream channel modifications.

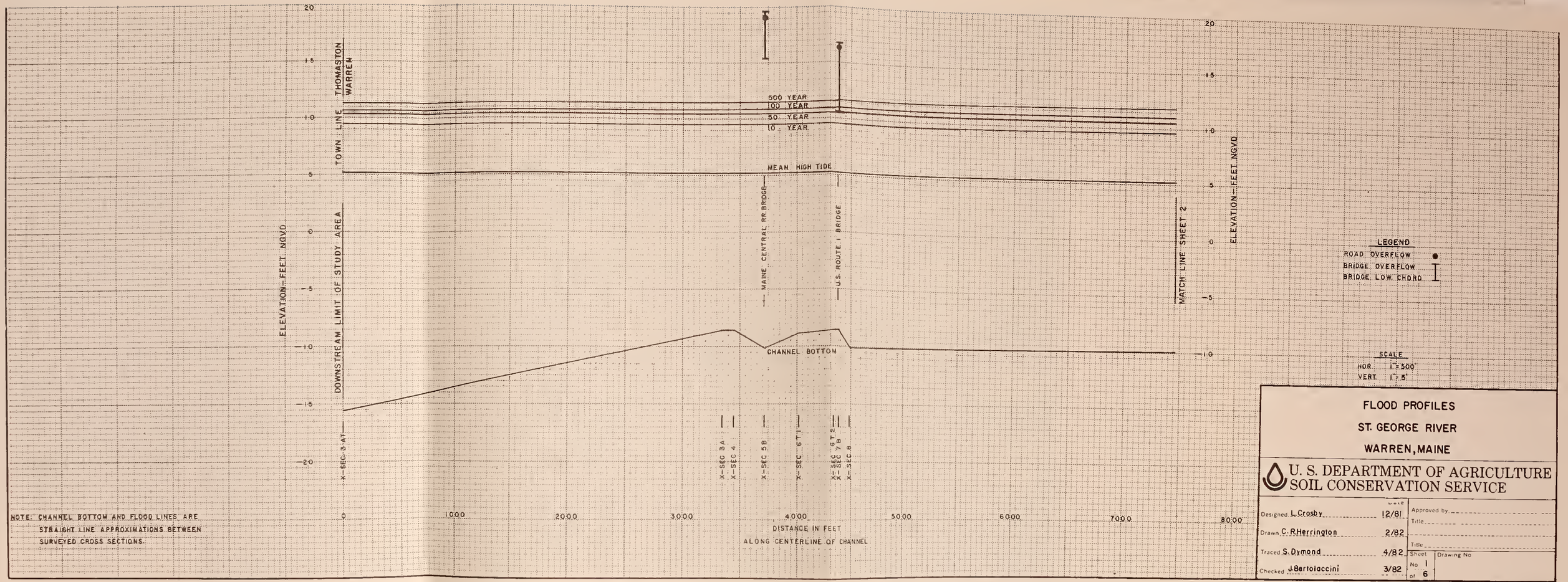
Bridge Data - Presents a summary of flood and other elevations for bridges within the study area. This information can also be obtained from the Flood Profiles.

Pond Data - Provides drainage areas and flood elevations for Seven Tree Pond, White Oak Pond and North and South Ponds. Flood levels on the above ponds are considered to be identical as explained in the Appendix - Investigations and Analyses. Also included in this table are the locations of the nearest elevation bench marks, descriptions of which are included in the Appendix.

Field surveys were obtained during the fall of 1980. Only those features in the flood plain at the time the surveys were completed were considered in the computations. Changes of bridge openings and/or flood plain encroachment will affect flood levels and necessitate updating the information given in this report. Additionally, major changes in land use due to future development within the watershed could cause a significant increase in flood discharges and require revisions in the data.


1
2
3
4
5
6
7
8
9
10
LEGEND
FLOOD PLAIN MAP
ELEVATION BENCH MARKS (APPENDIX)
STUDY AREA
2000 0 2000 4000 ft.
SCALE
FLOOD PLAIN MAP INDEX
ST. GEORGE RIVER
WARREN, MAINE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Drawn S.Dymond 7/82
Traced
Checked J.Bertolaccini 7/82
Approved by
Title
Date
Scale
Sheet No.
Drawing No.
SCS-ENG-21 Rev. 5-74


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
4 VALLEY CROSS SECTION
100 YEAR FLOOD ELEV.
SPEARS MILL RD.
STATE ROUTE 97
TOLL BRIDGE ROAD
MAINE CENTRAL R.R.
U.S. ROUTE 1
MATCH LINE
TOWN LINE
WARREN
THOMASTON
ST.
DOWNSTREAM LIMIT OF STUDY AREA
M N TR R.R.
U.S. ROUTE 1
LIMIT STUDY AREA
STATE ROUTE 131
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AS EXPLAINED IN THE NARRATIVE.
500' 0' 500' 1000'
APPROXIMATE
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 1 OF 10



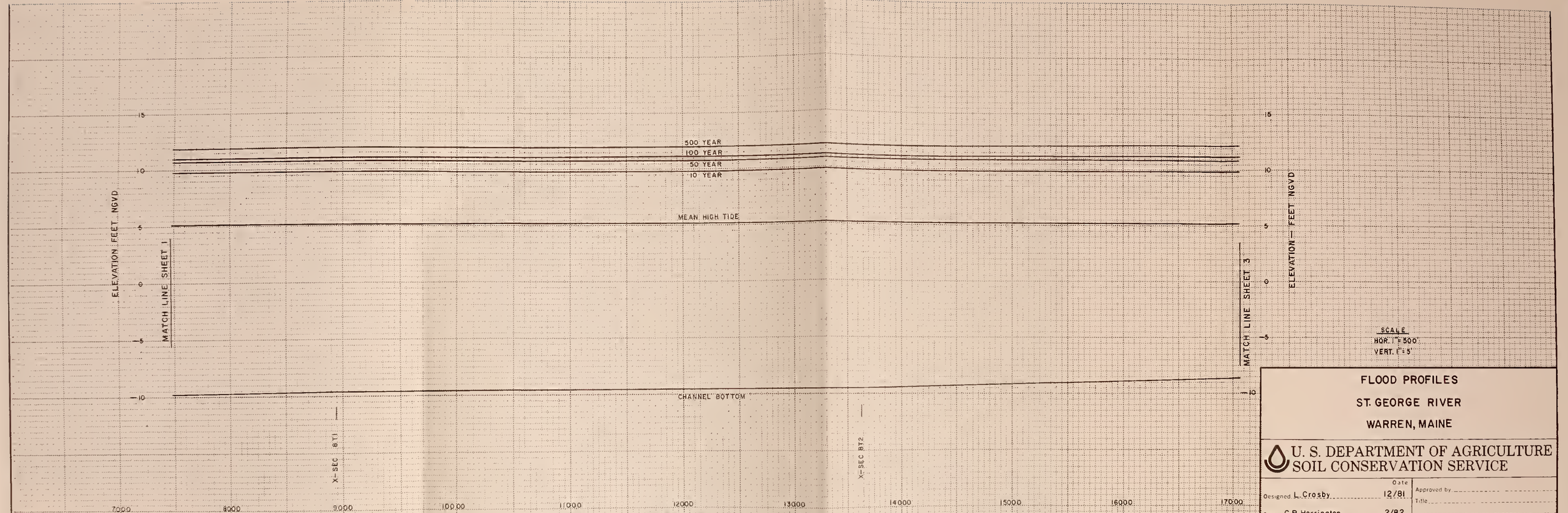
NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.

FLOOD PROFILES
ST. GEORGE RIVER
WARREN, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
Designed L. Crosby	12/81	Approved by
Drawn C. R Herrington	2/82	Title
Traced S. Dymond	4/82	Title
Checked J. Bertolaccini	3/82	Sheet No 1 of 6 — Drawing No


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
8T2 VALLEY CROSS SECTION
100 YEAR FLOOD ELEV.
US ROUTE 1
8T2
8T1
MATCH LINE
SHEET 1
SHEET 3
POINT RD
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AS EXPLAINED IN THE NARRATIVE.
500
1000
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 2 OF 10



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SCALE
HOR. 1" = 500'
VERT. 1" = 5'

FLOOD PROFILES
ST. GEORGE RIVER
WARREN, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Drawing No

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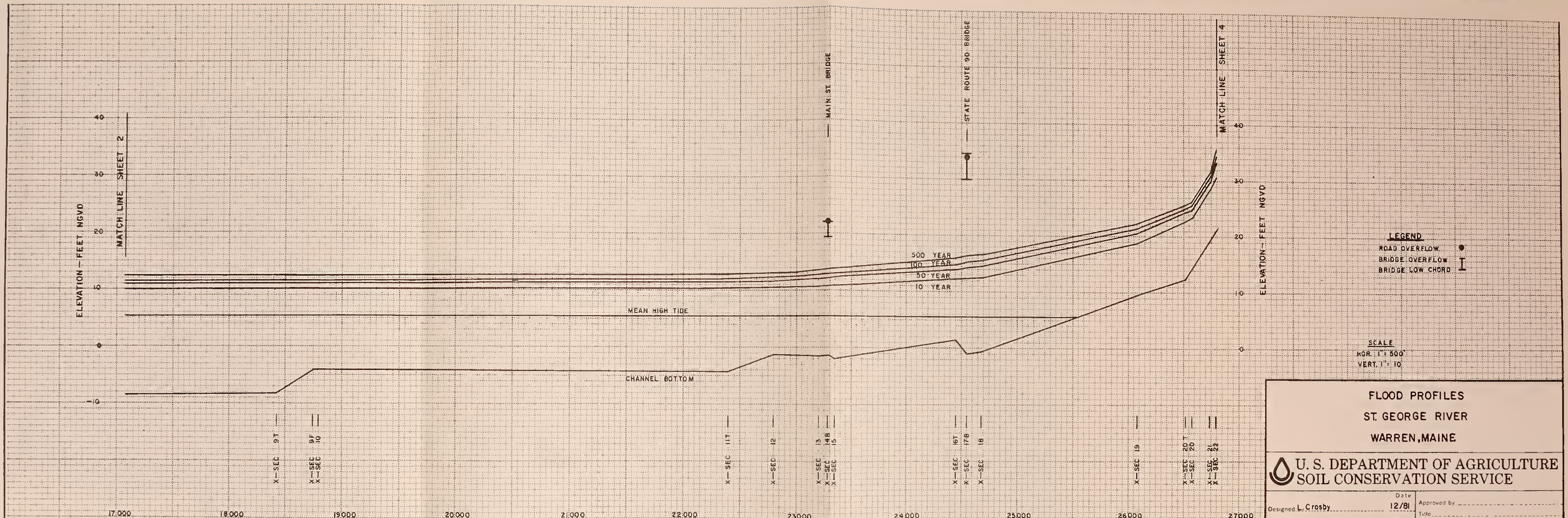
U.S. DEPARTMENT OF AGRICULTURE

FLOOD PLAIN MAP

FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 3 OF 10



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FLOOD PROFILES
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Drawing No

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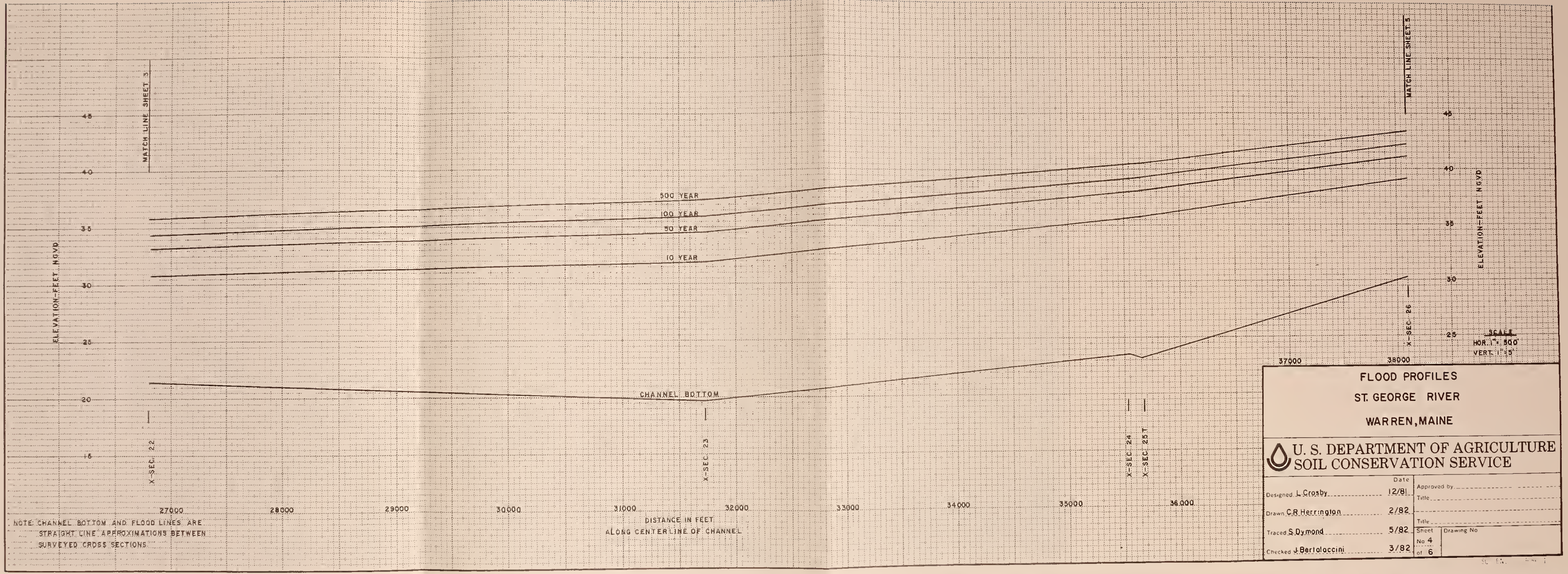
FLOOD PLAIN MAP

FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 4 OF 10



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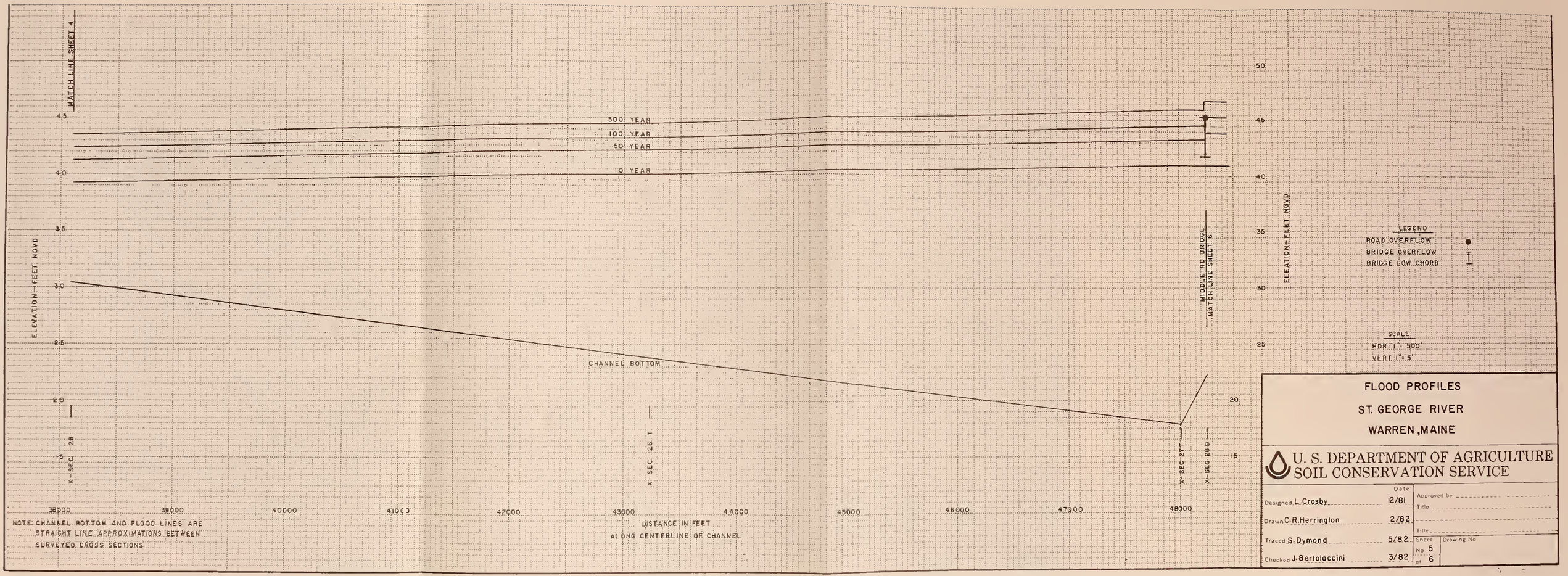
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 4
STATE ROUTE 131
ELECTRIC
VAUGHN'S
ROAD



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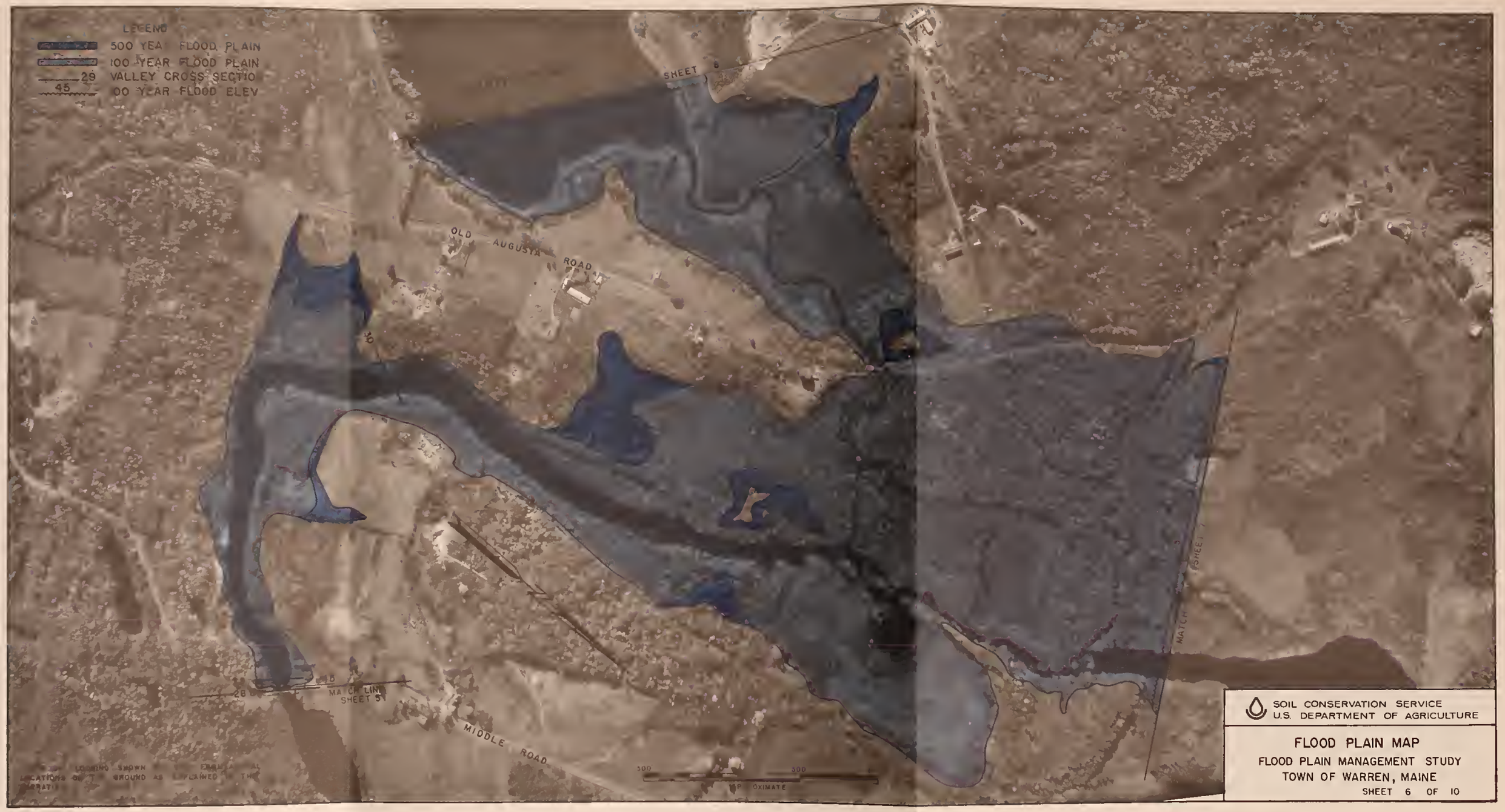
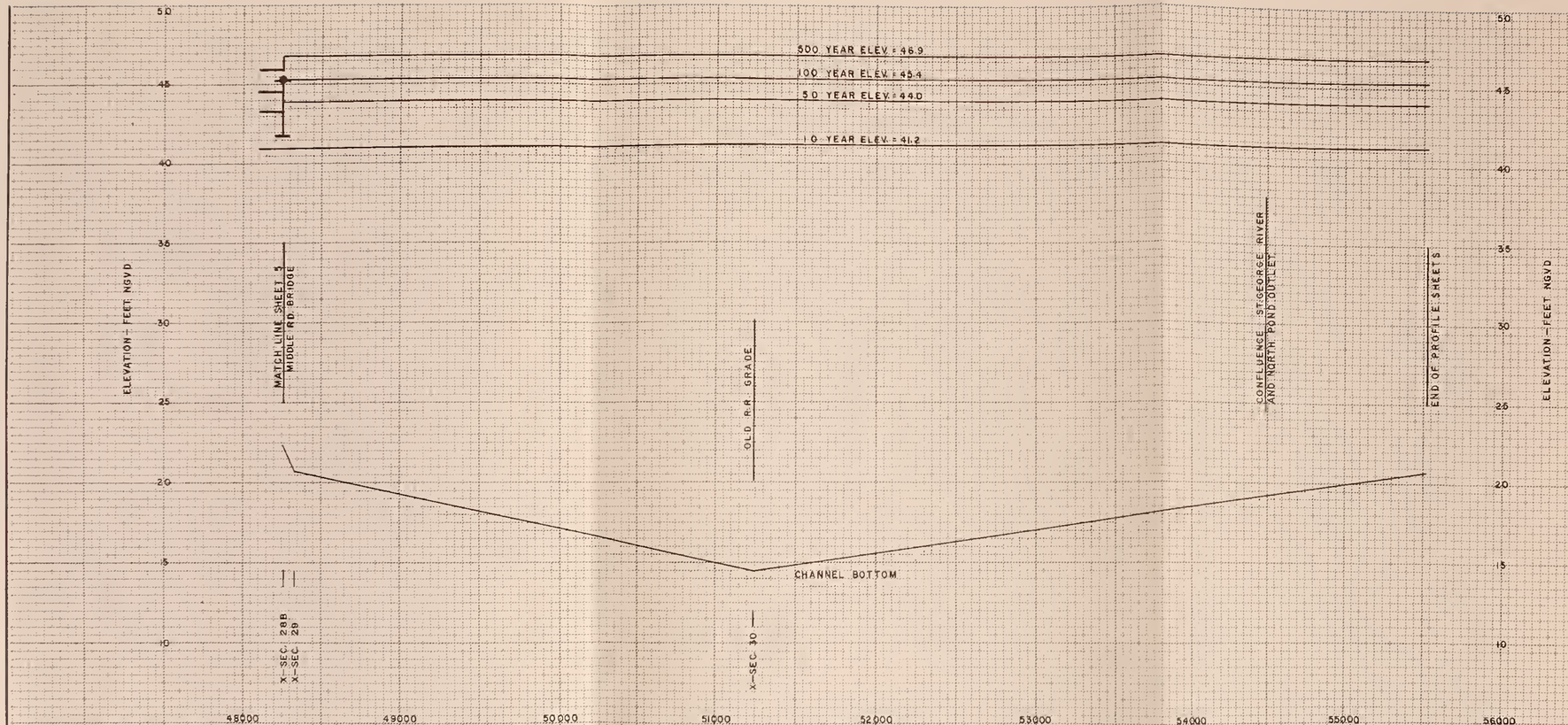

LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
29 VALLEY CROSS SECTION
45 100 YEAR FLOOD ELEV
SHEET 5
OLD AUGUSTA ROAD
MATCH LINE SHEET 5
MIDDLE ROAD
MATCH LINE (SHEET 7)
500 0 500
APPROXIMATE
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 6 OF 10



NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.

NOTE:
ELEVATIONS CONTINUE LEVEL UPSTREAM THRU. WHITE OAK POND, SEVEN TREE POND AND NORTH AND SOUTH PONDS

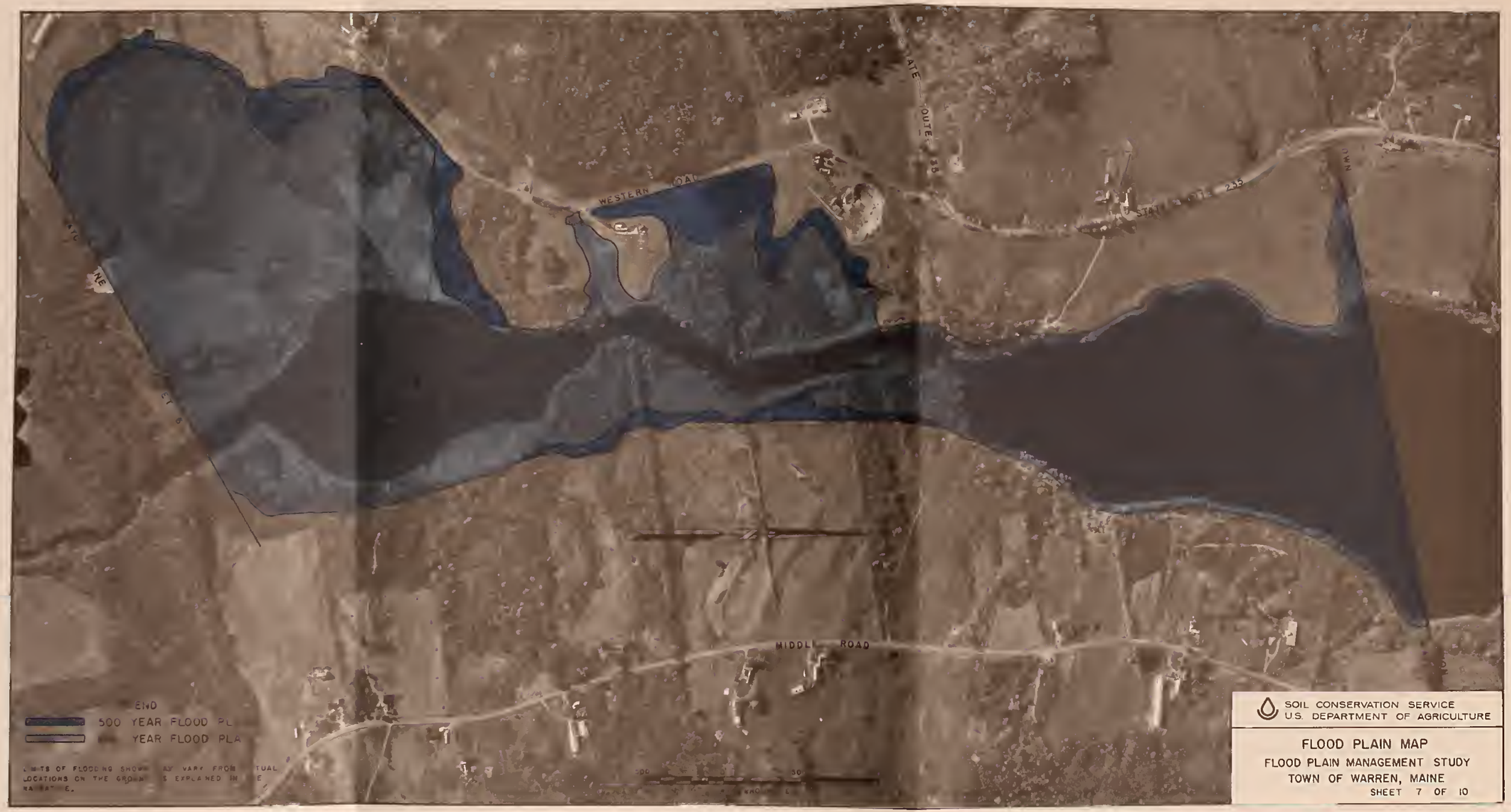
LEGEND
ROAD OVERFLOW
BRIDGE OVERFLOW
BRIDGE LOW CHORD

SCALE
HOR. 1" = 500'
VERT. 1" = 5'

FLOOD PROFILES
ST. GEORGE RIVER
WARREN, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

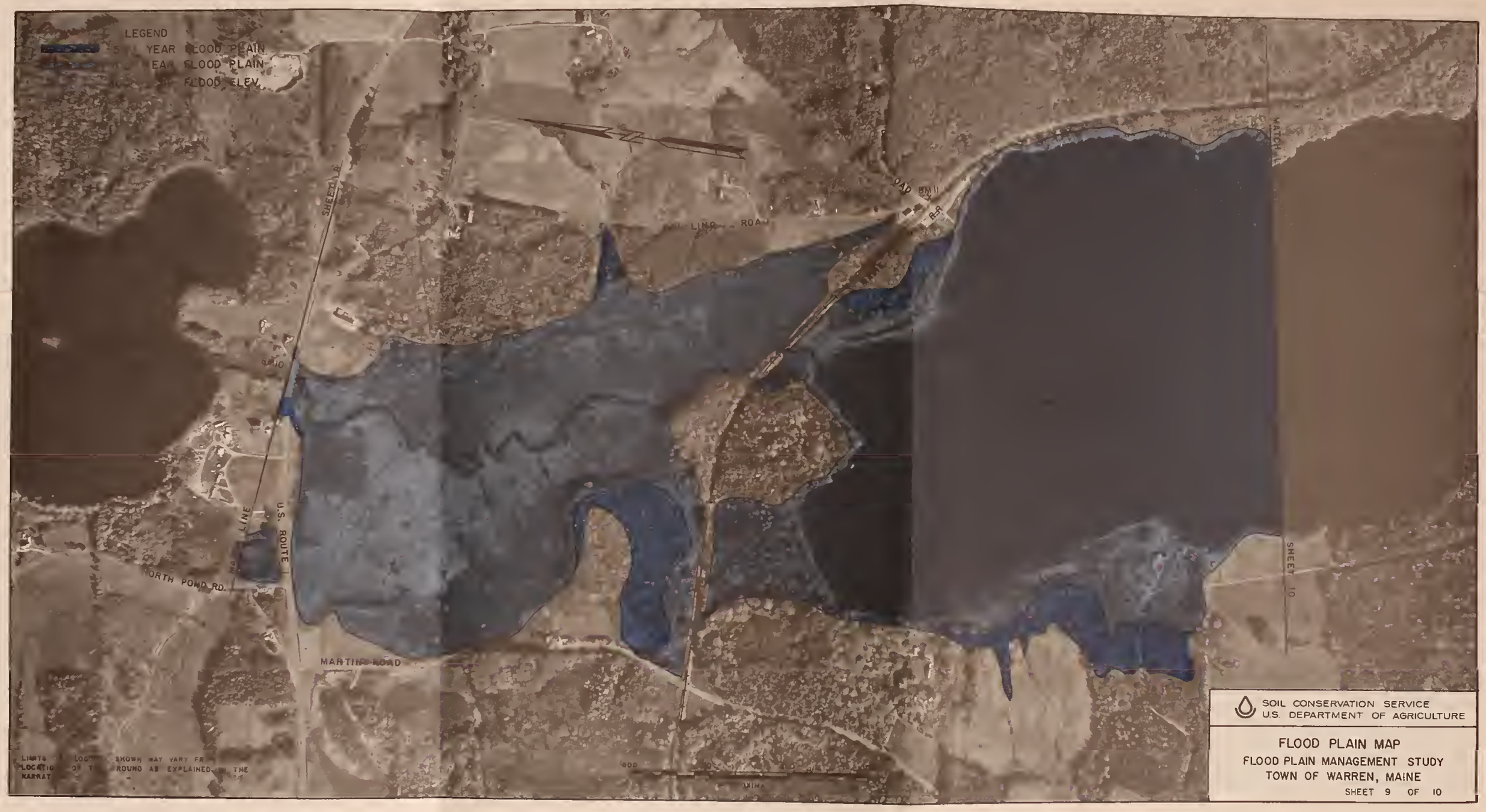
	Date	
Designed L. Crosby	12/81	Approved by
Drawn C.R. Herrington	2/82	Title
Traced S. Dymond	5/82	Title
Checked J. Bertolaccini	3/82	Sheet No 6 of 6 / Drawing No


WESTERN ROAD
STATE ROUTE 90
STATE ROUTE 235
MIDDLE ROAD
LEGEND
500 YEAR FLOOD PL
YEAR FLOOD PLA
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AS EXPLAINED IN THE NARRATIVE.
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 7 OF 10

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

FLOOD PLAIN MAP

FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 8 OF 10

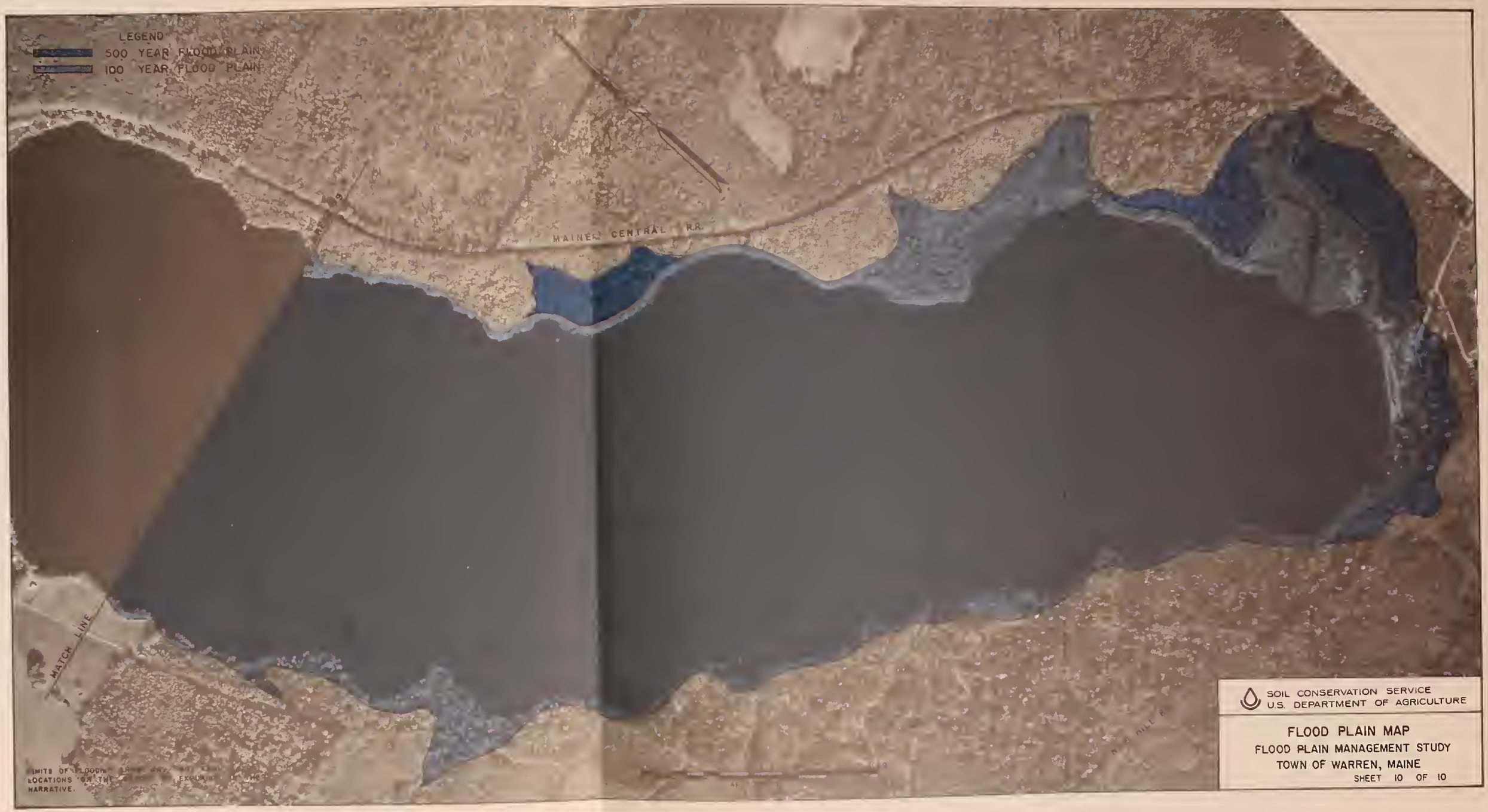


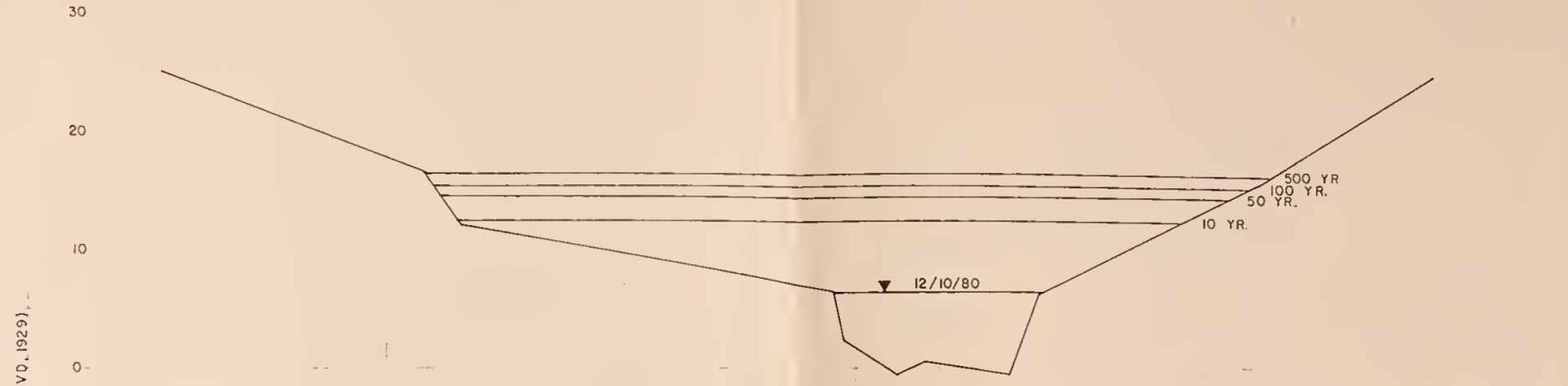
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

FLOOD PLAIN MAP

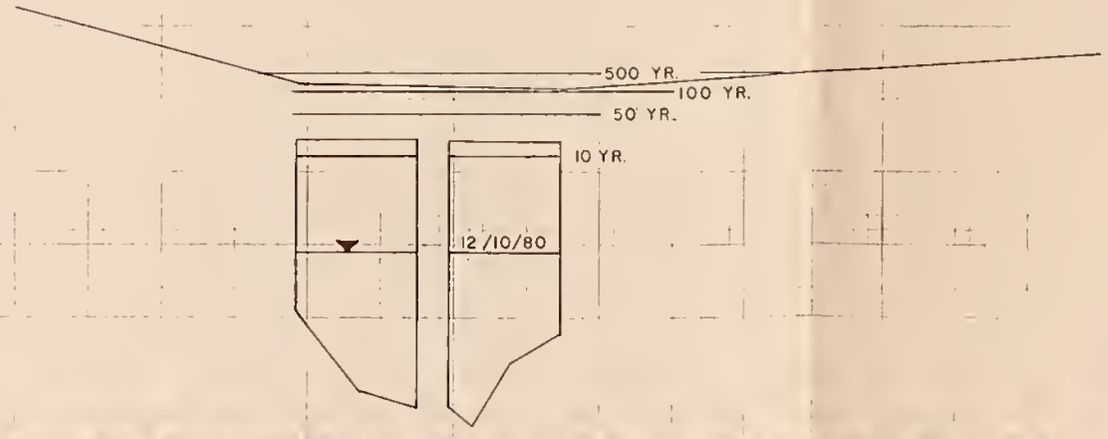
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE

SHEET 9 OF 10


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
MAINE CENTRAL R.R.
MATCH LINE
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF WARREN, MAINE
SHEET 10 OF 10



DISTANCE IN FEET—LOOKING UPSTREAM
CROSS SECTION 18
100 FEET UPSTREAM OF STATE ROUTE 90



DISTANCE IN FEET—LOOKING UPSTREAM
CROSS SECTION 28B
MIDDLE ROAD BRIDGE

ELEVATION IN FEET (NGVD, 1929)

SCALE
HOR. 1" = 50'
VERT. 1" = 10'

SELECTED CROSS SECTIONS
ST. GEORGE RIVER
WARREN, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date
Designed	L. Crosby	12/81
Drawn	C. R. Herrington	2/82
Traced	S. Dymond	5/82
Checked	J. Bertolaccini	3/82

Approved by
Title
Title
Sheet No. 1 of
Drawing No.

SCS-ENG-21 Rev. 7-76

APPENDIX

Investigations and Analyses

Topographic data were obtained from surveyed valley and bridge cross sections and U.S. Geological Survey topographic maps (3). Elevations are based upon National Geodetic Vertical Datum, 1929 (NGVD). Elevation bench marks that were used for this study are described in the Appendix and located on the Flood Plain Map Index.

Flood flows for various frequencies were computed from an analysis of stream hydraulics, soil cover, land use and rainfall data using the SCS TR-20 hydrologic evaluation model (4). Flood hydrographs were reservoir routed through 20 lakes and ponds in the watershed. Because of the vast amounts of flood storage afforded by these bodies of water it was suspected that storms in excess of 24 hours would generate the highest peak discharge. After an analysis of the one day, two day, four day, seven day, and ten day 100-year storms it was found that the seven day storm produced the highest discharges in the study area and was used for the flood hazard evaluation. A table of Selected Flood Discharges is included in the Appendix. Flood levels on Seven Tree Pond and White Oak Pond, North and South Ponds were found to be controlled by the Middle Road bridge. The seven day hydrographs were reservoir routed at that point resulting in identical flood levels on the above ponds.

Water surface profiles for various floods were computed by the WSP-2 computer program (5). Starting elevations were computed from tidal frequency data (6).

The boundaries of the 100-year and 500-year floods as shown on the maps were delineated from flood elevations determined at each cross section; between cross sections the boundaries were interpolated from USGS topographic maps (3) and aerial photographs (7).

The natural values inventory of the St. George River flood plain was accomplished in part by means of a canoe trip on the river in August 1981. Aerial photographs and topographic maps were also used in the inventory.

On February 4, 1982, a preliminary meeting was held with town officials to review a draft of the report and to solicit comments.

Field survey information, engineering computations, and other data pertinent to the study are on file with the Soil Conservation Service, USDA Office Building, University of Maine, Orono, Maine 04473, telephone (207) 866-2132.

SELECTED FLOOD DISCHARGES

St. George River

Cross Section No.	Location	Drainage Area (Mi^2)	Flood Discharges (CFS) 10-Year	50-Year	100-Year	500-Year
3AT	Warren-Thomaston Town Boundary	230.7	4230	6290	7480	8900
17B	State Route 90	198.7	3820	5680	6750	8050
28B	Middle Road	191.6	3730	5560	6590	7880

BRIDGE DATA

Cross Section No.	Location	Channel Bottom Elevations	Low Chord Elevations	Road Overflow Elevations	Flood Elevations 10-Year	50-Year	100-Year	500-Year
5B	Maine Central Railroad	-10.2	15.4	19.2	9.6	10.5	10.9	11.5
7B	U.S. Route 1	- 8.6	10.7	16.4	9.6	10.6	11.0	11.7
14B	Main Street	- 1.5	19.2	22.0	10.6	12.1	12.8	13.7
17B	State Route 90	- 1.1	29.9	33.9	12.3	14.3	15.2	16.4
28B	Middle Road	22.3	41.8	45.3	41.0	43.9	45.3	46.8
108C	Old Augusta Road	30.5	42.2	42.5	41.2	44.0	45.4	46.9
111C	U.S. Route 1	31.8	41.8	44.7	41.2	44.0	45.4	46.9
114B	Maine Central Railroad	32.0	43.1	46.4	41.2	44.0	45.4	46.9

Elevations refer to feet NGVD 1929, at upstream end of bridge opening.

POND DATA

Name	Nearest Elevation Bench Mark[1]	Drainage Area (Mi^2)	Assumed Elevation at Beginning of Storm[2]	Flood Elevations[2] 10-Year	50-year	100-year	500-year
Seven Tree Pond	9	158.5	34.5	41.2	44.0	45.4	46.9
White Oak Pond	8,9	173.2	34.5	41.2	44.0	45.4	46.9
North Pond	9,10	17.6	34.5	41.2	44.0	45.4	46.9
South Pond	11	9.6	35.5	41.2	44.0	45.4	46.9

1/ Refer to Bench Mark Descriptions - Appendix.

2/ Elevations refer to NGVD, 1929.

Bench Mark Descriptions

1. USC and GS BM Elev. 14.567

   Thomaston; 2.5 miles west along the Maine Central Railroad from the station at Thomaston; at the railroad bridge over the St. George River; at the east abutment; 6 feet south of the centerline of the track and 5 feet below the base of the rail; on the south end of the bridge seat; standard tablet stamped "Z 17 1933."

2. SCS BM Elev. 6.14

   Warren; 0.8 mile downstream from the bridge in the village of Warren; on right side of St. George River looking upstream; at end of foot path leading north from house that is approximately 300 feet downstream from BM; on high spot of ledge point; chiseled square.

3. SCS BM Elev. 25.07

   Warren; bridge over the St. George River next to the Crowe Rope Factory; east end of bridge; top of downstream wing wall; chiseled square.

4. SCS BM Elev. 33.81

Warren; 1,700 feet west along Route 90 from the intersection of Route 131 and 90; bridge over the St. George River; east abutment; south of centerline of highway; top of wing wall; chiseled square.

5. USC and GS BM Elev. 99.111

Warren; 0.4 miles northwest along State Highway 131 from the intersection of Route 90; 40 feet southwest of centerline of intersection; 33 feet northeast corner of a house; 32 feet south of center of road leading west; 33 feet west of the centerline of road leading south; 3 feet southeast of a tree and 2 inches underground; standard tablet stamped "P48 1935" and set in top of a concrete post.

6. SCS BM Elev. 32.98

Warren; Route 90 bridge over the St. George River; 0.4 mile up stream from bridge to Old Power House; 6 feet west toward river; top of 1 foot square concrete post 1.5 feet high; chiseled square.

7. SCS BM Elev. 33.85

Warren; Route 90 bridge over the St. George River; 1.4 miles upstream from bridge to the Merril Camp on east side of river; concrete slab which is base for rear porch stairs; top of and on downstream corner of slab; chiseled square.

8. SCS BM Elev. 45.20

Warren; Middle Road Bridge over the St. George River; northwest abutment; top of northeast wing wall; chiseled square.

9. SCS BM Elev. 44.17

Warren; old Augusta Road Bridge over the outlet stream of North Pond; north abutment; top of west wing wall; chiseled square.

10. DOT BM Elev. 35.10

Warren; U.S. Route 1 bridge over inlet stream to North Pond; 50 feet downstream from bridge; located in top of ledge on east bank near stream; standard tablet stamped "DOT WWT 1-E 1980."

11. USC and GS BM Elev. 53.701

Warren Station, Knox County; 73.5 feet southeast of the southeast end of station; 43.3 feet northeast of the centerline of the gravel road crossing; 32.5 feet northeast of the centerline of the track; top of ledge outcrop; standard tablet stamped "53.701 X 17 1933."

Glossary

Flood - An overflow or inundation onto land areas not normally covered by water that are used or usable by man. Floods are usually characterized as temporarily inundating land areas which are adjacent to a body of water such as an ocean, lake, stream or river.

Flood crest - The maximum stage or elevation reached by the waters of a flood at any location.

Flood peak - The maximum instantaneous discharge of a flood at a given location usually occurring at the flood crest.

Flood plain - The relatively flat area or lowlands adjoining the channel of a river, stream, or watercourse or ocean, lake, or other body of standing water which has been or may be covered by floodwater.

Flood profile - A graph which shows the relationship of water surface elevation to distance along the center line of channel. It is used in this report to show the crest elevations of specific floods.

Floodway - That portion of the main stream channel plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights.

Frequency - A statistical measure of how often an event of a given size or magnitude should, on the average, be equalled or exceeded.

(a) A 500-year frequency flood is one that is equalled or exceeded, on the average, once in 500 years. It has a 0.2 percent chance of being equalled or exceeded in any given year.

(b) A 100-year frequency flood is one that is equalled or exceeded on the average, once in 100 years. It has a 1 percent chance of being equalled or exceeded in any given year.

(c) A 50-year frequency flood is one that is equalled or exceeded on the average once in 50 years and has a 2 percent chance of being equalled or exceeded in any year.

(d) A 10-year freqency flood is one that is equalled or exceeded, on the average, once in 10 years and has a 10 percent chance of being equalled or exceeded in any year.

Head - The height of water above any plane or reference.

Head loss - The effect of obstructions, such as narrow bridge openings or buildings, that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Low chord - The elevation at which the bridge girder first begins to reduce the flow area of the channel.

Mean high tide - The average height of high tides observed over a specific 19-year tidal cycle (1941-59).

NGVD - National Geodetic Vertical Datum, formerly Mean Sea Level (MSL) 1929.

Normal river flow - That condition which represents average low flow within channel banks.

Road overflow - The elevation of the point at which water first starts to flow over the road.

Station - Distance in feet along the centerline of the existing channel, increasing in an upstream direction.

Valley cross-section - The vertical and horizontal configuration of a valley normal to the direction of water runoff. It is generally composed of the left flood plain, channel segment (s), and the right flood plain including any islands within the normal channel.

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3. U.S. Department of the Interior, Geological Survey, 7.5 Minute Topographic Maps, Thomaston, 1973; West Rockport, 1973; Union, 1973; and Waldoboro East, 1973.

4. U.S. Department of Agriculture, Soil Conservation Service, Technical Release 20, Computer Program, Project Formulation, Hydrology, Washington, DC, 1965.

5. U.S. Department of Agriculture, Soil Conservation Service, Technical Release 61, WSP-2 Computer Program, Washington, DC, 1976.

6. U.S. Army, Corps of Engineers, Tidal Flood Profiles, Waltham, MA, January 1980.

7. James W. Sewall Co., Aerial Photographs, 1:20,000 scale, Old Town, ME, October 1972.

U.S. Water Resources Council, A Unified National Program for Flood Plain Management, Washington, DC, September 1979.